A G R I C U L T U R A L   N E W S   L E T T E R

VOL. 3 - NO. 12 DECEMBER 1935

THIS PUBLICATION GIVES INFORMATION on new developments of interest to agriculture based on the work done by scientists and agricultural field men of the du Pont Company and its subsidiary companies.

It also gives reports of results obtained with products developed by these companies in the field whether the tests are made by field men of the companies, by agricultural experiment stations or other bodies. Also data on certain work done by agricultural stations on their own account and other matters of interest in the agricultural field.

This issue contains:

Issued by
Publicity Department,
E. I. du Pont de Nemours & Co.,
Wilmington, Del.

Printed in U.S.A.

UREA IS NOW AVAILABLE IN ADEQUATE QUANTITY DUE TO COMPLETION OF THE NEW DU PONT PLANT

EDITOR'S NOTE:- Domestic production of urea is of no little significance to agriculture, to an important branch of the plastics industry and in other fields. It is also indicative of the progress being made by the American chemical industry in the development of various synthetic products and the freeing of this country from dependence upon foreign sources of supply of essential materials.

Large-scale manufacture of urea, an important chemical and fertilizer material, is now an accomplished fact. This is a result of the recent completion of the urea plant of E. I. du Pont de Nemours & Company at Belle, near Charleston, West Virginia.

Heretofore, urea has been obtainable only from Germany or, to lesser extent, from other European sources, therefore its manufacture domestically marks another step in America's steady march toward chemical independence.

Urea is especially interesting to the scientific world because it was the first chemical compound identified with animal life to be synthesized by man from so-called inorganic or "mineral" substances. The chemist who accomplished this feat in 1828 was Wohler, a German. Wohler's synthesis of urea stimulated interest in organic chemical synthesis broadly and encouraged his contemporaries and successors to investigate the nature of all sorts of natural substances found in animal and plant life.

Not until nearly a century later, however, was urea manufactured on a commercial scale, as an outgrowth of the German nitrogen industry. During the past decade urea has gained importance as a fertilizer material and as a material for use in chemical processes. For example, urea combined with formaldehyde forms a resinous substance which is the basis for an important class of plastics. Urea is also used in manufacturing special glues and in the synthesis of certain drugs.

The du Pont urea manufacture is a logical extension of the Company's activity in the field of synthetic ammonia and fertilizer materials. The new plant has a potential capacity sufficient to supply the present domestic demand for urea.

##########

THE ABSORPTION OF AMMONIA AND NITRATE NITROGEN BY GRASS DISCUSSED AT OXFORD, ENGLAND, MEETING

EDITOR'S NOTE:- Dr. Parker has recently returned from a trip to Europe during which he attended the Third International Congress of Soil Science at Oxford, England. The following article is based in large measure on two papers presented before Commission IV of the Soil Congress. The papers, "The Nitrogen Cycle in Grassland Soils" by Rhichardson and "The Relative Rates of Uptake of Ammonium and Nitrate Nitrogen by Perennial Rye Grass" by Lewis, appear in Volume 1 of the Transactions of the Soil Congress.

By F. W. Parker, Agronomist,
Ammonia Department,
E. I. du Pont de Nemours & Co.

Several investigators working in the United States have studied the absorption of ammonia and nitrate nitrogen by various plants including corn, wheat, oats, tomatoes, cotton and buckwheat. All of these experiments were in solution or sand cultures. Rhichardson of the Rothamstead Agricultural Experiment Station has studied the problem under field conditions and Lewis of the Agricultural Research Station of Imperial Chemical Industries has studied it under controlled conditions approximating those in natural soils.

Rhichardson has found that in grassland soils equilibria exist under which neither ammonia nor nitrate nitrogen accumulates to any considerable extent, but that the level of ammonia nitrogen is consistently above that of nitrate nitrogen. The equilibria are rapidly restored after the addition of nitrogenous fertilizers. Added ammonia disappears in a few days in the spring and added nitrate disappears equally fast. The added nitrogen appears to be absorbed by the grass as rapidly in the form of ammonia as in the form of nitrate. Nitrate production from ammonia was slight and in one experiment ammonia was removed from an acid soil when herbage was present, but persisted when the herbage was not present.

In his study of the nitrogen cycle in grassland soils, Rhichardson has followed the decomposition of plant roots and residues. Normally, decomposition is most rapid in the early spring and falls to a minimum in late summer. Laboratory investigations established the fact that nitrification was rapid under laboratory conditions. The inference was drawn that nitrification was slow in the field and that much of the nitrogen made available in the normal course of the cycle is absorbed as ammonia by the grass.

Continued on next page

In his paper, Lewis points out the fact that comparatively little is known about the absorption of ammonia and nitrate nitrogen under field conditions. After considering various ways of making the study, Lewis decided to use an artificial medium similar to soil, but free of organic matter and of very low nitrifying power. The medium consisted of 6 per cent calcium bentonite and 94 per cent quartz sand.

The experiment was conducted in 10-inch pots and perennial rye grass was raised from seed. During an establishment period of eight weeks the plants received plenty of phosphorus and potash and a little nitrogen. They were not cut drastically. After the eight-week period, ammonia and nitrate nitrogen treatments were started. Three series of plants were grown. These were cut at heights of 3 inches, 4 inches and 6 inches respectively. The following table gives the results secured.

Continued on next page

Table 1

DRY WEIGHT AND NITROGEN CONTENT OF GRASS
FERTILIZED WITH AMMONIA AND NITRATE NITROGEN

Establishment Period
0.25 gm. N applied per pot
0.27 " P_2O_5 " " "
1.00 " K_2O " " "

Experimental Period
0.75 gm. N applied per pot
0.50 " P_2O_5 " " "
1.00 " K_2O " " "

		Dry weight gms		PerCent Nitrogen		N uptake per pot. gms	
		Ammonia	Nitrate	Ammonia	Nitrate	Ammonia	Nitrate
Series A	1st cut	3.63	3.42	5.59	5.04	.2025	.1716
	2nd cut	3.24	2.54	4.09	4.26	.1322	.1074
	3rd cut	7.61	7.46	2.08	2.31	.1569	.1721
	Total	14.48	13.42	3.40	3.36	.4916	.4509
Series B	1st cut	8.67	7.07	3.70	3.70	.3194	.2588
	2nd cut	8.47	8.18	1.93	2.16	.1618	.1764
	Total	17.14	15.24	2.81	2.85	.4812	.4351
Series C	1st cut	16.03	12.38	2.68	2.76	.4296	.3404
	2nd cut	5.97	5.99	2.15	2.38	.1281	.1423
	Total	22.00	18.36	2.54	2.63	.5577	.4827
Average of Totals		17.87	15.67	2.85	2.91	.5101	.4562

The data show that the dry weight of the plants grown with ammonia nitrogen was consistently greater than the weight of the nitrate plants. The percentage of nitrogen in the plants was about the same with both forms of nitrogen, but the plants grown with ammonia nitrogen recovered more of the added nitrogen. All three series showed similar differences, but the differences were greatest in Series C where the grass was cut at a height of six inches.

The plants were also analyzed for phosphoric acid and the data are given in Table 2.

Continued on next page

Table 2

PHOSPHORUS CONTENT OF GRASS FERTILIZED WITH AMMONIA AND NITRATE NITROGEN

		P_2O_5: % of dry matter		P_2O_5: gm. per pot	
Series	Cut	Ammonium Sulphate	Sodium Nitrate	Ammonium Sulphate	Sodium Nitrate
A.	1st	1.088	.678	.0390	.0233
	2nd	.525	.513	.0180	.0120
	Final	.781	.746	.0600	.0604
B.	1st	.488	.378	.0459	.0258
	Final	.645	.588	.0564	.0500
C.	1st	.307	.273	.0513	.0345
	Final	.654	.575	.0389	.0365

The phosphoric acid content of the grass was higher where the nitrogen was applied as ammonia than where it was applied as nitrate. This may have been due to the ammonium salts being physiologically acid, thereby increasing the solubility of the phosphate in the sand-calcium bentonite medium.

In conclusion, Lewis expresses the opinion that a good deal of the nitrogen absorbed by grass under field conditions is absorbed as ammonia. Furthermore, that when ammonium salts are used as fertilizers, appreciable amounts of ammonia are absorbed by the grass.

RUFFED-GROUSE RESEARCH IN MINNESOTA REVEALS IMPORTANT FACTS ABOUT A VALUABLE GAME BIRD

EDITOR'S NOTE:- This article, which appears in The Du Pont Magazine, is presented here for the information of those interested in wild-life research and game management. The findings of Professor King contribute in an important way to a better understanding of the fluctuation in numbers of ruffed grouse in ten-year cycles and supplies other interesting data.

By Harriet Premack

"Closing the hunting season will not solve the problem of wild-life conservation," says Ralph T. King, University of Minnesota zoologist, who, for the past six years, has devoted his time to an extended study of the habits of Minnesota's ruffed grouse, or partridge.

"Whether we shoot the birds or not, their numbers will fluctuate according to a definite cycle, which human interference does not disturb," he declares in contradicting the popular belief. "An intelligent attempt to give wild-life a decent break, in the form of scientific management, is the only way to stop the rapid diminution of our wild-game resources."

With this purpose in mind, to give wild-life a decent break, Professor King has been at work. For fifty-nine consecutive months, he or his assistants have walked the forty-two miles of "strip" which cuts a 3,000-acre area near Cloquet, Minnesota, into quarter-mile squares, in order to study in minute detail the foods, distribution and nesting habits of the birds of the area. The work is still going on, but results that will greatly affect wild-game management in the future, it is believed, are beginning to take shape.

Besides studying the birds on this area he has made a study of old letters, diaries, old shooting journals, express company shipping records, sporting journals and the biennial reports of the Board of Game and Fish Commissioners of Minnesota. These have given Professor King a knowledge of hunting conditions in that state, with special reference to ruffed grouse, since 1814. The records up to 1871 are scattered; since then there is an annual record.

Continued on next page

Increase and Decrease

The significant fact disclosed is that the numbers of certain species of wild game fluctuate in ten-year cycles, rising slowly and dropping swiftly with surprising regularity. Neither weather, drouth nor hail have any correlation with this condition. Nor do hunting restrictions make an appreciable difference, as Professor King reads the records. His own studies support these disclosures.

The data he has collected since 1930 coincide exactly with the ten-year cycle revealed in his studies of past conditions. In 1931 there were 520 birds on the Cloquet project area. In 1932 there were 700. The following year, 1933, there were 990, and in 1934 the number fell to 520. This change occurred despite the fact that there was no hunting on the area and that conditions changed very little from one year to the next.

Two other facts of importance have been established by the study so far: First, ruffed grouse have a definite cruising radius of one-half mile. They will not, even if they starve to death, go any farther for food or for any other reason. They live and die within the same half-mile area. For this reason, their entire food and cover requirements, which are as definite and as complicated as those of human beings, must be found in this area.

Second, "carrying capacity of land" - a new phrase in wild-life terminology - has real significance. It refers concretely to the number of wild animals a given piece of land can support. For example, Herbert L. Stoddard, Georgia quail expert, recently demonstrated clearly that the carrying capacity of land for quail is one bird per acre. The owner of an island in the Mississippi River asked Mr. Stoddard to increase the quail stock for him. Mr. Stoddard worked the island quail population up to one bird per acre and declared that his work was finished. Not satisfied, the owner purchased 2,000 birds and placed them on the island. Within eighteen months the number of quail on the island was back to the ratio of one quail to each acre. Professor King's studies show that ruffed grouse need even more elbow room, and that land with one bird to every four acres has reached its carrying capacity.

Just how is the information secured that makes such conclusions possible?

In 1928 ten sporting arms and ammunition companies organized an institute designed to build up wild-life in the United States. This institute established a group of full-time research fellowships. One of these, on the cyclic life of the ruffed grouse, was assigned to Professor King. Since that time, he has worked on the project almost continuously.

Continued on next page

Every month, he and four or five assistants tramp the forty-two miles of strip on the Cloquet project, set aside for this work by the University of Minnesota. In the twelve-week spring session thirty-five or forty junior foresters and wild-life managers live and study there.

Each man, equipped with a note-book and a map of the area, begins to walk an hour after sun-up, waiting until that time so that birds will be through feeding and will have returned to their normal distribution. Each man notes the plant species he enccunters, and every object that may have the slightest bearing on the life of the ruffed grouse. Most of all he watches for the birds themselves. When he flushes one, he stops and notes its flying direction. Then, he establishes his bearings and paces the distance to the nearest intersection of the strip. In this way, he marks the exact spot on which he found the bird. Every bird flushed and every nest found is recorded both on the map and in the note-book, together with much other information.

Method of Identification

Confusion and duplication are carefully avoided by thorough methods of identifying the birds. After much experimentation, seven dyes were found which would withstand climatic conditions and remain on feathers. A quantity of white feathers was obtained and dyed. Colored feathers, in varying combinations of three colors each, are grafted into the tails of the birds while they are young. It is possible, therefore, to identify a bird, whenever it is seen, from a distance of from forty to forty-five yards.

In addition to the colored tail feathers, a metal clip, stamped with a number and recorded in the ever-present note-book, is fastened to each bird's leg.

But this identification is scarcely practicable for the young bird. Spending twenty-four days in the egg, it hatches out the size of a penny match-box, and, as soon as its down is dry, leaves the nest and never comes back. Therefore, the nests are watched and the young birds are caught as soon as they are hatched. A metal clip, like that used for incisions in human operations, and stamped with a number, is fastened under the bird's wing. By a system of serial numbers, not only the date of the bird's hatching is recorded, but its parentage and its brothers and sisters.

Accuracy and painstaking recording of the most minute details are the keystones on which the work is progressing. This makes possible the tabulation of much information relevant to the problem studied, while not intrinsically bound up with it. For instance, Professor King has discovered that not all the animals commonly suspected of being hostile to the ruffed grouse actually are. On the other hand, those which have been least suspected often do the most damage.

Continued on next page

"The chipmunk is an example," says this observer. "He evidently thinks partridge eggs make fine marbles. He rolls them out of the nest, plays with them and hides them, usually without breaking them."

Ruffed-Grouse Research

On one occasion, Professor King found a nest with twelve eggs. Next morning, they were gone. Suspecting a chipmunk, he searched about and found all twelve. He replaced them in the nest and every egg hatched.

This project is not complete. The results thus far point to a very definite life cycle, which is affected neither by climatic conditions nor by human interference. They prove that the "half-mile cruising radius" and the "carrying capacity of land" must be reckoned with. Above all, they point to the conclusion that if wild-life is to be restored in the United States, it must be given every opportunity to speak for itself; to point out, in its own terms, its own destiny.

Prohibiting shooting will not solve the problem!

COTTON SEEDLING STANDS INCREASED BY TREATING SEED WITH DUST DISINFECTANTS REPORTS INDICATE

EDITOR'S NOTE:- The reports quoted below are from the October 1935 issue of Phytopathology, the official organ of The American Phytopathological Society.

A Resume of Cottonseed Treatments in South Carolina.- C. H. Arndt.

A resume was given of the effect of cottonseed treatments with dusts of the type of Ceresan* on germination and yields in South Carolina since 1929. The data as presented were a composite of the results of W. D. Moore, 1929-30; E. E. Hall at the Pee Dee Experiment Station 1930-34; and for the Clemson College Experiment Station 1931-34. Treating natural seed increased the average stand of seedlings eighteen per cent and increased the average yield 5.7 per cent. Acid delinting of the seed increased the average stand 50 per cent and the average yield 8.5 per cent as compared to natural, linted seed. Treating acid-delinted seed increased the average stand 25 per cent as compared to nontreated delinted seed, but did not increase the average yield. Machine-delinted seed gave an average increase of 80 per cent in stand, and increased the average yield one per cent in tests over a three year period as compared to natural seed. Treating machine-delinted seed gave an additional average increase in stands of 35 per cent, and five per cent in the average yields. Dr. Moore's results show significant reductions in the amount of angular leaf spot when treated seed was used.

Results from Ten Years' Work on Cotton Seed Treatment.- B. B. Higgins. (Georgia).

In a more than ten-year field study of the efficiency of various disinfectant treatments for cotton seed some have given perfect control of angular leaf spot and considerable reduction of seedling anthracnose. Our records show small but consistent yield increases from the better dust treatments, even when planted in plats alternated with plats or rows planted with nontreated seed. Apparently, this increase was correlated with the better stand obtained with treated seed. In isolated walled beds constructed in a field where cotton had not been grown for twenty-five years, treated seed gave one and one-half to four times the yield obtained from the check bed with an equal number of plants from nontreated seed, the first three years. The fourth year one hundred pounds of cotton seed was worked into the soil of each bed during the winter in order to get the soil evenly infested with

Continued on next page

the soil organisms usually carried on seed, especially *Fusarium moniliforme*. During the following three years the yields from the check bed have approximately equaled those from beds planted with treated seed.

The results indicate that disinfection of cotton seed may have considerable value for seed of low germination, such as that saved during a rainy season, and especially valuable when planting on land not devoted to cotton for several years.

----

*"Ceresan" is the trade name for ethyl mercury phosphate dust developed and manufactured by the Bayer-Semesan Company, Wilmington, Del.

BASIC CONSIDERATIONS IN THE USE OF DYNAMITE FOR BLASTING FARM AND OTHER DRAINAGE DITCHES

EDITOR'S NOTE:- It is a recognized fact that the development of the propagation method of blasting ditches was the greatest single contribution of explosives experts to the practical application of dynamite to drainage purposes. The advantages of propagation and the conditions under which it may be applied are clearly set forth below.

By L. F. Livingston, Manager,
Agricultural Extension Section,
E. I. du Pont de Nemours & Co.

When a single charge of dynamite is loaded at the proper depth in soil and shot it makes a hole of the shape of an inverted cone. The sides of this cone are usually at a 45-degree angle with the surface -- or at a 1 to 1 slope.

A blasted ditch is a series of overlapping craters, each made by the explosion of an individual charge of dynamite. It is obtained by so arranging the charges that all will explode at one time.

Two Methods of Shooting

The charges of dynamite for a ditch blast may be exploded by the propagation method or the electric method.

The propagation method makes use of the concussion caused by the explosion of the dynamite in an initial hole to propagate the detonation of the charges in other holes in succession. This is so rapid that the individual explosions of all the holes seem like a simultaneous blast. In this method a cartridge of dynamite in but one of the holes is primed. Either an electric blasting cap or a blasting cap and fuse may be used for a primer.

Moisture in the soil is the key to propagation. When the initial charge is set off by the blasting cap, the explosion is carried by the detonating wave through the moisture contained in the soil. A general "rule of thumb" to determine moisture content is to pick up a handful of soil; if water is squeezed out from between the fingers, the soil has sufficient moisture to carry the detonating wave. In many instances, soil with much less moisture will allow successful propagation. If there is an insufficient amount of water in the soil, the detonation goes but a short distance; the larger the amount of water in the soil, the greater will be the effective distance of the detonating wave. Hence in loose, wet muck, the detonating wave is carried the maximum distance.

Continued on next page

The weight of the particles of soil also have a direct bearing on the distance that propagation is effective. A heavy sand will not allow the detonating wave to be carried as far as fine loam. As the size of the load increases, the distance between holes can be lengthened.

The electric method requires that an electric blasting cap be placed in each charge, and that all the charges be wired together in series and shot with a blasting machine.

Because of the added expense for extra blasting caps and for almost twice as much labor, the electric method is used only where there is not sufficient moisture in the soil to ensure effective propagation.

Choice of Firing Methods

In dry soil, the electric method must be used. In wet soil, the propagation method is generally applied. On a small, one-stick ditch, the electric method of shooting will double the cost.

On large ditches, the additional electric blasting caps required by the electric method are not such a large factor; but the extra labor required to insert electric blasting caps in each charge and to make the necessary wiring connections, and also the limited length of ditch obtained when using the electric method, emphasizes the advantages of the propagation method of exploding dynamite charges when blasting ditches. Always use the propagation method wherever possible, engineers advise.

##########

INDEX TO NUMBERS SEVEN TO TWELVE, JULY-DECEMBER, 1935, VOLUME THREE

NOTE: This index is for the convenience of readers who preserve copies of this publication. Copies of back numbers are not available.

****

Insecticides -- Fungicides

****

Seed Disinfectants

****

Miscellaneous

##########